TIGGER Transit Investments for Greenhouse Gas and Energy Reduction

U.S. Department of Transportation
Federal Transit Administration

Courtesy of Tim Jewett, TriMet

Project name: TriMet Light-Rail On-Board Energy Storage System

Transit agency: Tri-County Metropolitan Transportation District of Oregon

Location: Portland, Oregon

TIGGER goal: Energy reduction

FTA region number: X

Award amount: $4,200,000

Congressional district: OR-1, OR-3, and OR-5

Funding mechanism: Appropriations

TriMet Pioneers Use of Double-Layer Capacitors for On-Board Energy Storage in Light-Rail Vehicles

The Tri-County Metropolitan Transportation District of Oregon (TriMet) is improving the energy efficiency of its light-rail fleet with a $4.2 million TIGGER Program grant.

Rail Project

TriMet operates a fleet of 127 light-rail vehicles, 101 of which feature regenerative braking—upon deceleration, the vehicle motors function as generators and make power available to the traction electrification system. However, TriMet studies indicate that only 70% of this regenerated power is captured and used by nearby light-rail trains. When no trains are near, the remaining 30% of the regenerated power is lost.

To remedy this energy loss, American Maglev Technology will install double-layer capacitor units on 20 light-rail vehicles in the TriMet fleet. The air-cooled capacitor units will release previously stored electrical energy upon acceleration, thus using nearly 100% of the regenerated power captured from braking trains.

The Tri-County Metropolitan Transportation District of Oregon (TriMet) provides public transportation for much of Multnomah, Clackamas, and Washington counties in the Portland, Oregon, metro area. TriMet's service area covers 574 square miles and includes nearly 1.5 million residents. TriMet operates a comprehensive public transit network including a 52-mile, 85-station Metropolitan Area Express (MAX) light-rail system, a 15-mile Westside Express Service (WES) commuter-rail system, 79 bus lines, and door-to-door service for seniors and people with disabilities. Approximately 318,000 customers ride TriMet's fixed routes each weekday.

Courtesy of Jason Grohs, TriMet

Clockwise from top left: The double layer capacitor enclosure, the power control unit, and the double layer capacitor modules.

The capacitor-equipped vehicles will be paired with non-capacitor-equipped vehicles so that the captured energy can be used to accelerate both vehicles.

The maximum energy storage capacity of each roof-mounted capacitor unit is about 1 kWh, which should be sufficient for accelerating a vehicle to 25 mph and operating it for about 2,500 feet on level track. In addition to capturing energy and reducing peak-load demand, these capacitor units reduce power substation loads and allow the light-rail system to grow in train density without installing additional substations.

Impact:

By pioneering the use of double-layer capacitors for on-board energy storage in light-rail vehicles, TriMet is providing other transit agencies with an example of a cost-effective retrofit option for reducing energy consumption in light-rail vehicle fleets.

The capacitor units feature a high level of efficiency, an extremely dynamic charge-transfer capacity, excellent cycle strength, and a long (15 year) service life.

To validate the energy savings, TriMet will compare in-service energy consumption data taken from on-board vehicle propulsion computers before and after the retrofit. According to preliminary data, retrofitting the vehicles with capacitor units will result in annual energy savings of 2.8%.

The first capacitor unit will be installed and tested in early 2012, with the remaining units placed into service by late summer 2012.

About TIGGER

The Transit Investment for Greenhouse Gas and Energy Reduction (TIGGER) Program *was established in 2009 by the U.S. Department of Transportation's Federal Transit Administration (FTA). Designed to reduce energy use and greenhouse gas emissions in transit agencies around the country, the TIGGER Program made funds available for capital investments that would reduce greenhouse gas emissions or lower the energy use of public transportation systems. An initial $100 million in American Recovery and Reinvestment Act grants funded 43 competitively-selected transit projects. In 2010, the FTA provided an additional $75 million in grants to fund 27 new TIGGER projects. These 70 projects are employing a variety of technologies to meet the program goals, including solar installations, building efficiency improvements, wind technology, wayside energy storage for rail, and purchase of more efficient buses. In fiscal year 2011, FTA provided an additional $49.9 million to continue the program.*

For More Information

TriMet:
www.trimet.org

FTA TIGGER:
www.fta.dot.gov/TIGGER

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TIGGER FS - OR-88-0001 - February 2012